```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import datetime as dt     #Number of Trips by Date
import geopandas as gpd  # Fixed import statement for geopandas
import folium
from folium import plugins
import folium
E_trip = pd.read_csv("/content/drive/MyDrive/E-Scooter_Trips_-_2020.csv")
E_trip
```

```
E_trip[E_trip.duplicated()].sum()
```

```
Trip ID                       0.0
Start Time                    0.0
End Time                      0.0
Trip Distance                 0.0
Trip Duration                 0.0
Vendor                        0.0
Start Community Area Number   0.0
End Community Area Number     0.0
Start Community Area Name     0.0
End Community Area Name       0.0
Start Centroid Latitude       0.0
Start Centroid Longitude      0.0
Start Centroid Location       0.0
End Centroid Latitude         0.0
End Centroid Longitude        0.0
End Centroid Location         0.0
dtype: float64
```

3 2649-49be- 05:00:00 05:00:00 5 21 spin 31.0 31.0 LOWER LOWER 41

```
# Remove Comma from Values
E_trip["Trip Duration"] = E_trip["Trip Duration"].str.replace(",", "")
E_trip["Trip Distance"] = E_trip["Trip Distance"].str.replace(",", "")
# Convert Data Type to Int
E_trip["Trip Duration"] = E_trip["Trip Duration"].astype("int")
E_trip["Trip Distance"] = E_trip["Trip Distance"].astype("float")
```

... ... ChatGPT ... ...

```
# Convert Start Time Data Type to Datetime
E_trip['Start Time'] = pd.to_datetime(E_trip['Start Time'])

# Extract Date from Start Time Column
E_trip['Start Date'] = pd.to_datetime(E_trip['Start Time']).dt.date

E_trip['Start Date'] = pd.to_datetime(E_trip['Start Date'])
```

1639a6894a18 PM PM

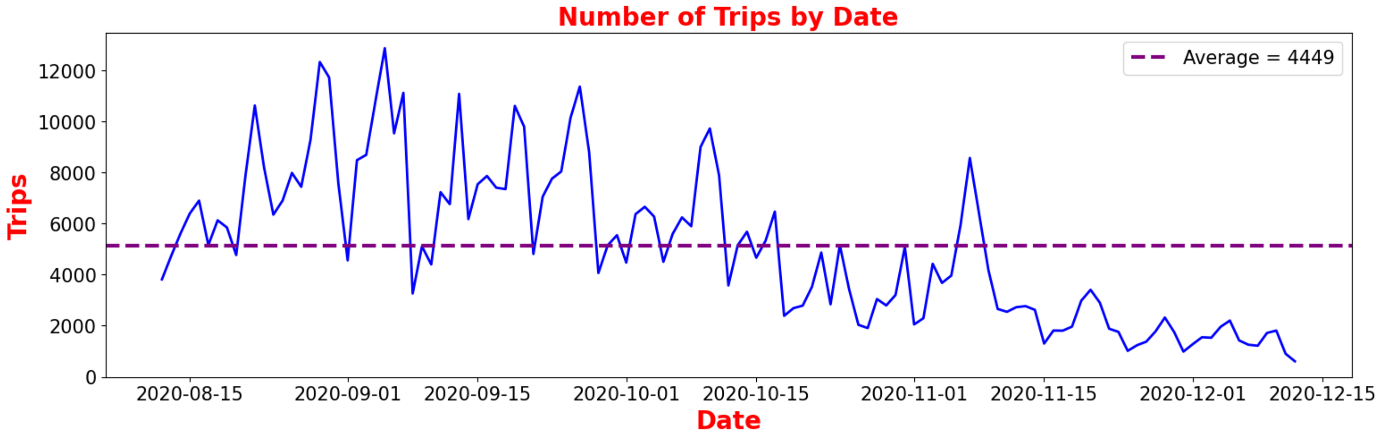
```
#Number of Trips by Date
ntd = E_trip['Start Date'].value_counts().reset_index()
ntd.columns = ['Date','Trips']

ntd.head()
```

	Date	Trips
0	2020-09-05	12868
1	2020-08-29	12327
2	2020-08-30	11724
3	2020-09-26	11364
4	2020-09-07	11120

```
# Averae Trips per day
atpd = ntd['Trips'].mean()
atpd
```

```
5128.585365853659
```

```
plt.figure(figsize = (18, 5))
plot = sns.lineplot(x = "Date", y = "Trips", data = ntd, color = "blue", linewidth = 2)
plot.axhline(atpd, linestyle="--", color="purple", label="Average = 4449", linewidth = 3)
plt.title("Number of Trips by Date", size = 20, color = "red", weight = "bold")
plt.xlabel("Date", size = 20, color = "red", weight = "bold")
plt.ylabel("Trips", size = 20, color = "red", weight = "bold")
plt.legend(prop={'size': 15})
plt.xticks(size = 15)
plt.yticks(size = 15)
plt.show()

#Trips constantly start to decrease below average after Novebeer 07, 2020
```



```
#Number of Trips by Day of Week
# Extract Day Name from Start Date Column
E_trip["Day of Week"] = E_trip["Start Date"].dt.day_name()
```

ChatGPT

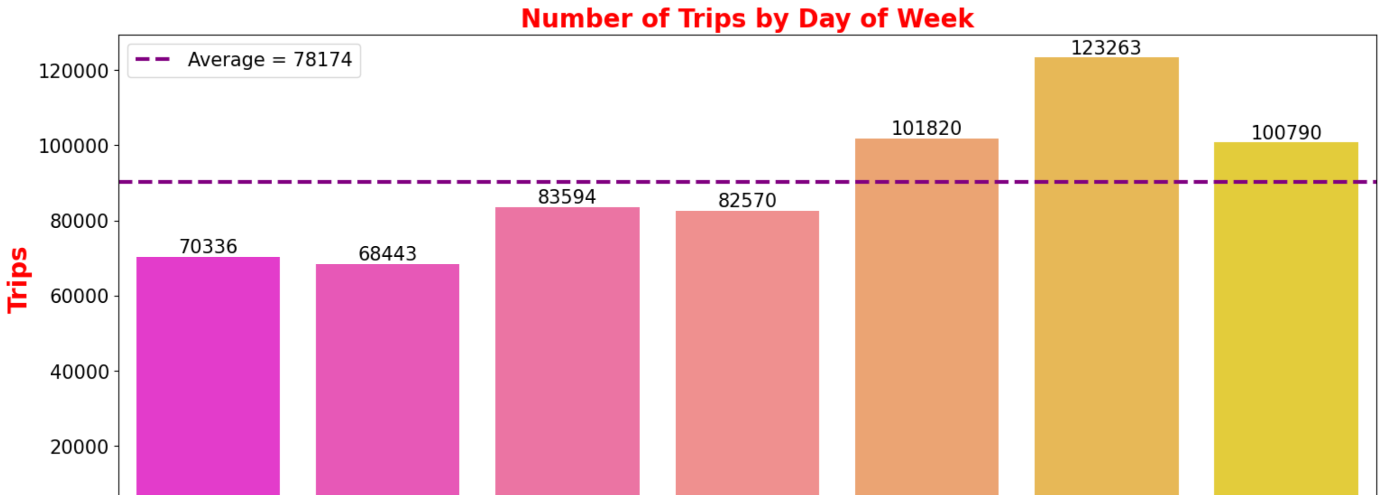
```
cats = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sunday']
tdw =  E_trip['Day of Week'].value_counts().reindex(cats).reset_index()

tdw.columns = ["Day of Week", "Trips"]
tdw
```

	Day of Week	Trips
0	Monday	70336
1	Tuesday	68443
2	Wednesday	83594
3	Thursday	82570
4	Friday	101820
5	Saturday	123263
6	Sunday	100790

```
atdw = tdw["Trips"].mean()
atdw
```

```
90116.57142857143
```

```
plt.figure(figsize = (18, 7))
plot = sns.barplot(x = "Day of Week", y = "Trips", data = tdw, palette = "spring")
for p in plot.patches:
        plot.annotate('{:.0f}'.format(p.get_height()),
                      (p.get_x()+0.4, p.get_height()),
                       ha='center', va='bottom',color= 'black', size = 15)
plot.axhline(atdw, linestyle="--", color="purple", label="Average = 78174", linewidth = 3)
plt.title("Number of Trips by Day of Week", size = 20, color = "red", weight = "bold")
plt.xlabel("Day", size = 20, color = "red", weight = "bold")
plt.ylabel("Trips", size = 20, color = "red", weight = "bold")
plt.legend(prop={'size': 15})
plt.xticks(size = 15)
plt.yticks(size = 15)
plt.show()
```



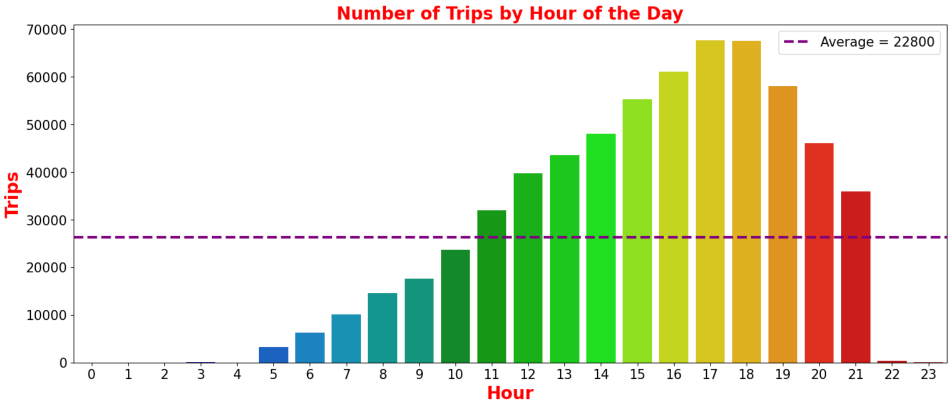
```
#Distribution of Trips over Hours of the Day

E_trip["Hour"] = E_trip["Start Time"].dt.hour


thd = E_trip["Hour"].value_counts().to_frame().sort_index().reset_index()
thd.columns = ["Hour", "Trips"]
thd
```

	Hour	Trips
0	0	17
1	1	12
2	2	7
3	3	39
4	4	21
5	5	3201
6	6	6271
7	7	10153
8	8	14597
9	9	17649
10	10	23626
11	11	31971
12	12	39673
13	13	43585
14	14	48099
15	15	55324
16	16	61115
17	17	67605
18	18	67568
19	19	58006
20	20	45999
21	21	35939
22	22	299
23	23	40

```
athd = thd["Trips"].mean()
athd
```

```
26284.0
```

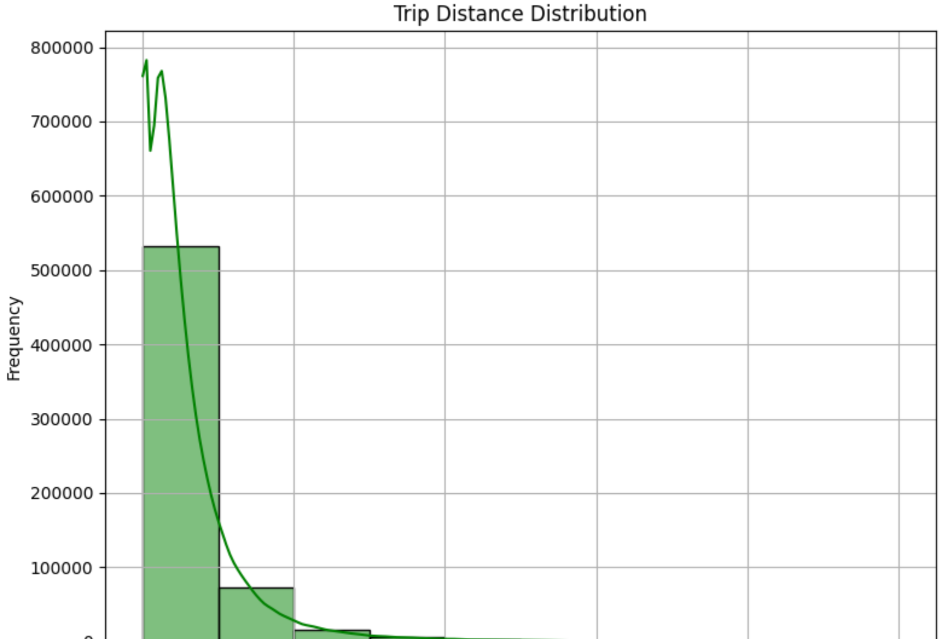
```
plt.figure(figsize = (18, 7))
plot = sns.barplot(x = "Hour", y = "Trips", data = thd, palette = "nipy_spectral")
plot.axhline(athd, linestyle="--", color="purple", label="Average = 22800", linewidth = 3)
plt.title("Number of Trips by Hour of the Day", size = 20, color = "red", weight = "bold")
plt.xlabel("Hour", size = 20, color = "red", weight = "bold")
plt.ylabel("Trips", size = 20, color = "red", weight = "bold")
plt.legend(prop={'size': 15})
plt.xticks(size = 15)
plt.yticks(size = 15)
plt.show()
```



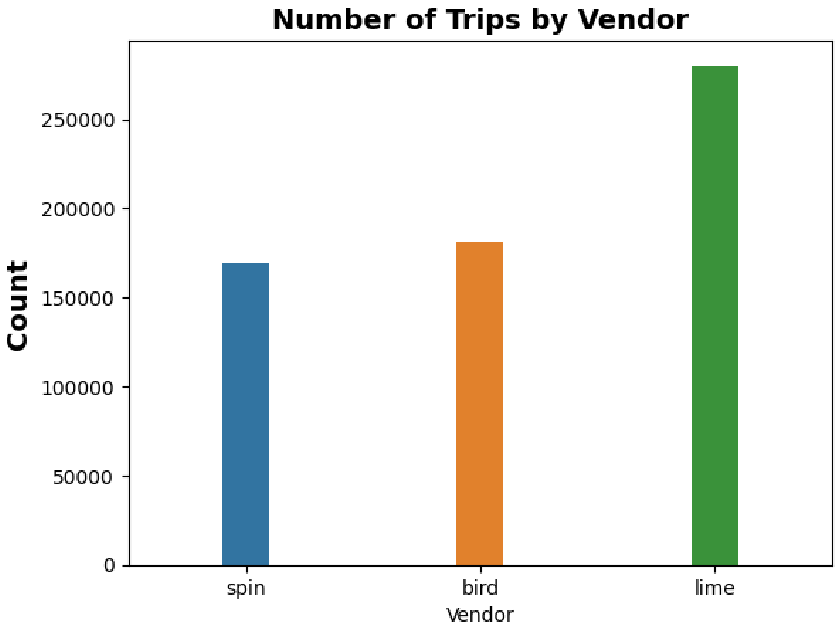
```
# Calculate the average trip distance (in miles or kilometers)
average_distance = E_trip['Trip Distance'].mean()

# Calculate the average trip duration (in seconds, minutes, or hours)
average_duration = E_trip['Trip Duration'].mean()

# Print the results
print(f'Average Trip Distance: {average_distance} miles')
print(f'Average Trip Duration: {average_duration} seconds')
```

```
Average Trip Distance: 2909.7930553441893 miles
Average Trip Duration: 996.0292303936488 seconds
```

```
plt.figure(figsize=(8, 6))
sns.histplot(E_trip['Trip Distance'], bins=10, kde=True, color='green')
plt.title('Trip Distance Distribution')
plt.xlabel('Trip Distance (miles)')
plt.ylabel('Frequency')
plt.tight_layout()
plt.grid(True)
plt.show()
```



```
E_trip['Trips'] = ntd['Trips']


#Bar chart of 'Vendor' counts
# Create a countplot with custom bar width
sns.countplot(x='Vendor', data=E_trip, width=0.2)  # Adjust the width as needed
plt.xlabel('Vendor')
plt.ylabel('Count', fontsize=14, fontweight='bold')
plt.title('Number of Trips by Vendor', fontsize=14, fontweight='bold')
plt.show()
```

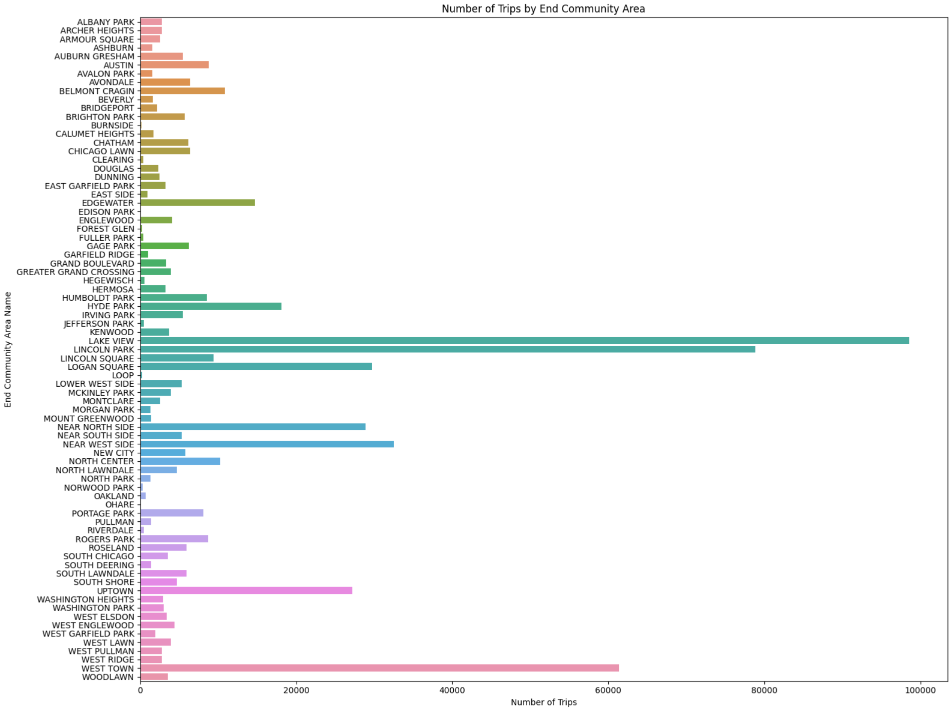


```
#. Number of Trips by Start Community Area:
trips_by_start_area = E_trip["Start Community Area Name"].value_counts()
print("Number of Trips by Start Community Area:")
print(trips_by_start_area)
```

```
Number of Trips by Start Community Area:
LAKE VIEW          99318
LINCOLN PARK       80704
WEST TOWN          61413
NEAR WEST SIDE     32739
LOGAN SQUARE       29330
                    ...
```

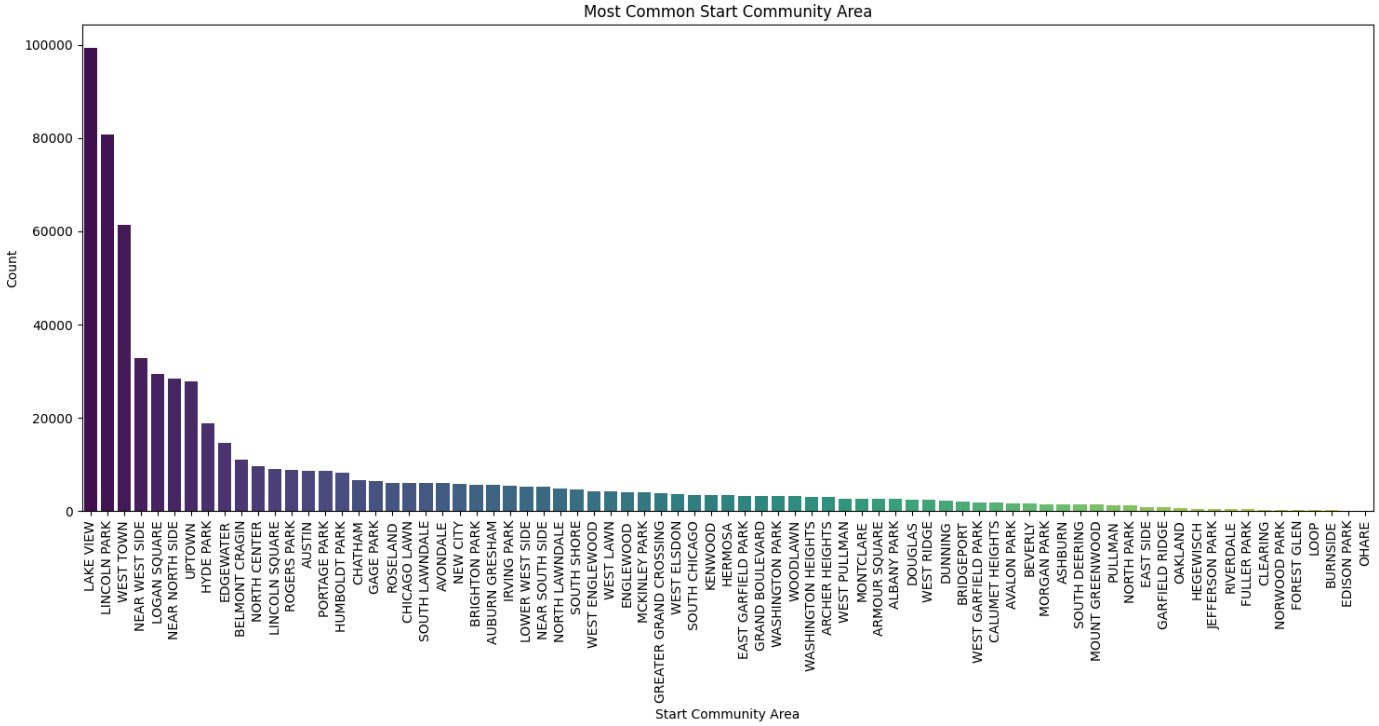
```
FOREST GLEN         177
LOOP                159
BURNSIDE            147
EDISON PARK          31
OHARE                15
Name: Start Community Area Name, Length: 77, dtype: int64
```

```
# Assuming you have a DataFrame named 'E_trip' with 'End Community Area Name'
# and 'Number of Trips' columns

# Group by 'End Community Area Name' and count the number of trips for each area
trips_by_end_area = E_trip.groupby('End Community Area Name')['Trip ID'].count().reset_index()
trips_by_end_area.columns = ['End Community Area Name', 'Number of Trips']

# Create a bar chart
plt.figure(figsize=(16, 12) ) # Optional: Set the figure size
sns.barplot(x='Number of Trips',y='End Community Area Name', data=trips_by_end_area, orient='h')
plt.xlabel('Number of Trips')
plt.ylabel('End Community Area Name')
plt.title('Number of Trips by End Community Area')
plt.xticks(rotation=0)  # Keep y-axis labels horizontal
plt.tight_layout()  # Optional: Adjust layout for better label display
plt.show()
```



```
#Most Common Start Community Area
most_common_start_area = E_trip["Start Community Area Name"].mode().iloc[0]
print("Most Common Start Community Area:", most_common_start_area)

# Count the occurrences of each start community area
start_area_counts = E_trip["Start Community Area Name"].value_counts()

# Create a bar chart
plt.figure(figsize=(15, 8))
sns.barplot(x=start_area_counts.index, y=start_area_counts.values, palette="viridis")
plt.xlabel("Start Community Area")
plt.ylabel("Count")
plt.title("Most Common Start Community Area")
plt.xticks(rotation=90)  # Rotate x-axis labels for readability
plt.tight_layout()
plt.show()
```

```
Most Common Start Community Area: LAKE VIEW
```



```
list(E_trip.columns)
```

```
['Trip ID',
 'Start Time',
 'End Time',
 'Trip Distance',
 'Trip Duration',
 'Vendor',
 'Start Community Area Number',
 'End Community Area Number',
 'Start Community Area Name',
 'End Community Area Name',
 'Start Centroid Latitude',
 'Start Centroid Longitude',
 'Start Centroid Location',
 'End Centroid Latitude',
 'End Centroid Longitude',
 'End Centroid Location',
 'Start Date',
 'Day of Week',
 'Hour',
 'Trips']
```

```
E_trip.to_csv('/content/E_2020.csv', index=False)
```

```
!pip install pyspark

from pyspark.sql import SparkSession
```

```
Collecting pyspark
  Downloading pyspark-3.5.0.tar.gz (316.9 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 316.9/316.9 MB 4.2 MB/s eta 0:00:00
  Preparing metadata (setup.py) ... done
Requirement already satisfied: py4j==0.10.9.7 in /usr/local/lib/python3.10/dist-packages (from pyspark) (0.10.9.7)
Building wheels for collected packages: pyspark
  Building wheel for pyspark (setup.py) ... done
  Created wheel for pyspark: filename=pyspark-3.5.0-py2.py3-none-any.whl size=317425344 sha256=b801f824c6137309d2586fcfee56d093
  Stored in directory: /root/.cache/pip/wheels/41/4e/10/c2cf2467f71c678cfc8a6b9ac9241e5e44a01940da8fbb17fc
Successfully built pyspark
Installing collected packages: pyspark
Successfully installed pyspark-3.5.0
```

```
spark = SparkSession.builder.appName("MySparkSession").getOrCreate()
```

```
df = spark.read.csv("/content/E_2020.csv", header=True, inferSchema=True)
```

```
df.createOrReplaceTempView("my_table")
```

```
# 1. Calculate the total trip distance for each vendor
query1 = "SELECT Vendor, SUM(`Trip Distance`) AS TotalDistance FROM my_table GROUP BY Vendor"

spark.sql(query1).show()
```

```
+------+-------------+
|Vendor|TotalDistance|
+------+-------------+
|  spin|  5.6981084E8|
|  lime| 5.88243083E8|
|  bird| 6.77490093E8|
+------+-------------+
```

```
# 2. Find the average trip duration for each vendor
query2 = "SELECT Vendor, AVG(`Trip Duration`) AS AverageDuration FROM my_table GROUP BY Vendor"
spark.sql(query2).show()
```

```
+------+------------------+
|Vendor|   AverageDuration|
+------+------------------+
|  spin|1010.0427554564808|
|  lime| 1030.965914770861|
|  bird| 928.8947586321107|
+------+------------------+
```

```
# 3. Calculathe total number of trips for each community area
query3 = "SELECT `Start Community Area Name`, COUNT(*) AS TotalTrips FROM my_table GROUP BY `Start Community Area Name`"
spark.sql(query3).show()
```

```
+-------------------------+----------+
|Start Community Area Name|TotalTrips|
+-------------------------+----------+
|            BRIGHTON PARK|      5683|
|             LINCOLN PARK|     80704|
|                MONTCLARE|      2624|
|                  HERMOSA|      3343|
|                     LOOP|       159|
|          BELMONT CRAGIN|     11041|
|                ROSELAND|      6127|
|                 OAKLAND|       609|
|         WASHINGTON PARK|      3274|
|    GREATER GRAND CRO...|      3794|
|          AUBURN GRESHAM|      5631|
|             SOUTH SHORE|      4546|
|          SOUTH LAWNDALE|      6046|
|          GARFIELD RIDGE|       845|
|                    NULL|       882|
|          LINCOLN SQUARE|      8965|
|             EDISON PARK|        31|
|                 DOUGLAS|      2461|
|             FULLER PARK|       376|
|             IRVING PARK|      5484|
+------------------------+----------+
only showing top 20 rows
```

```
# 4. Find the date with the highest total trip distance
query4 = "SELECT `Start Date`, SUM(`Trip Distance`) AS TotalDistance FROM my_table GROUP BY `Start Date` ORDER BY TotalDistance DES
spark.sql(query4).show()
```

```
+----------+-------------+
|Start Date|TotalDistance|
+----------+-------------+
|2020-09-05|  4.0556994E7|
+----------+-------------+
```

```
spark.stop()
```

```
from pyspark.sql import SparkSession
from pyspark.sql.functions import avg, count, max

# Create a Spark session
spark = SparkSession.builder.appName("TripAnalysis").getOrCreate()

# Load your dataset into a DataFrame (Replace 'your_data.csv' with your dataset file)
df = spark.read.csv("/content/E_2020.csv", header=True)
```

```
long_trips_df = df.filter(df["Trip Duration"] > 30)
long_trips_df.show()
```

```
+--------------------+-------------------+--------------------+-------------+-------------+------+---------------------------+-
|             Trip ID|         Start Time|            End Time|Trip Distance|Trip Duration|Vendor|Start Community Area Number|E
+--------------------+-------------------+--------------------+-------------+-------------+------+---------------------------+-
|3eb9a2a3-3266-455...|2020-08-12 05:00:00|08/12/2020 05:00:...|       1153.0|         1027|  spin|                       68.0|
|82dd7b8f-8de0-4f2...|2020-08-12 05:00:00|08/12/2020 05:00:...|         17.0|           91|  spin|                       22.0|
|9120cbf3-f749-49b...|2020-08-12 05:00:00|08/12/2020 05:00:...|       2883.0|          724|  spin|                        3.0|
|0448afb5-ab64-409...|2020-08-12 07:00:00|08/12/2020 07:00:...|       1179.0|          245|  spin|                        6.0|
|5b7425e1-0b21-46d...|2020-08-12 07:00:00|08/12/2020 07:00:...|       3815.0|          840|  spin|                        6.0|
|18433ae5-4c8b-4c8...|2020-08-12 07:00:00|08/12/2020 07:00:...|         13.0|          101|  spin|                        7.0|
|2486c853-5196-4e5...|2020-08-12 07:00:00|08/12/2020 07:00:...|         24.0|          105|  spin|                        7.0|
|a5b7250d-51b9-450...|2020-08-12 07:00:00|08/12/2020 07:00:...|       4709.0|         1421|  spin|                        7.0|
|3a60d75f-86a2-449...|2020-08-12 07:00:00|08/12/2020 07:00:...|       4642.0|         1285|  spin|                        7.0|
|87efd199-16da-41b...|2020-08-12 07:00:00|08/12/2020 07:00:...|        365.0|          110|  spin|                        6.0|
|5a7f8b18-ff8b-4c8...|2020-08-12 07:00:00|08/12/2020 07:00:...|          8.0|          152|  spin|                       16.0|
|28b787ff-de26-48c...|2020-08-12 07:00:00|08/12/2020 07:00:...|          7.0|           50|  bird|                       77.0|
|063f3b4d-ec43-47b...|2020-08-12 08:00:00|08/12/2020 10:00:...|      22692.0|         8141|  bird|                       22.0|
|d65f0cf6-30ce-45f...|2020-08-12 08:00:00|08/12/2020 08:00:...|        543.0|          942|  spin|                       49.0|
|995aca16-e33e-4f6...|2020-08-12 08:00:00|08/12/2020 08:00:...|         15.0|          110|  spin|                        6.0|
|8c4df140-8dec-477...|2020-08-12 08:00:00|08/12/2020 08:00:...|       4931.0|         1142|  spin|                        6.0|
|8e4f04ef-94f6-4f6...|2020-08-12 08:00:00|08/12/2020 08:00:...|         24.0|           71|  spin|                        3.0|
|091ff507-b351-40d...|2020-08-12 08:00:00|08/12/2020 08:00:...|        604.0|          174|  spin|                        3.0|
|88d26323-f194-4fd...|2020-08-12 08:00:00|08/12/2020 08:00:...|         16.0|         1245|  lime|                       19.0|
|dbfeb629-2f20-44a...|2020-08-12 08:00:00|08/12/2020 09:00:...|       4714.0|         2548|  spin|                        3.0|
+--------------------+-------------------+--------------------+-------------+-------------+------+---------------------------+-
only showing top 20 rows
```

```
day_of_week_count = df.groupBy("Day of Week").agg(count("*").alias("count"))
day_of_week_count.show()
```

```
+-----------+------+
|Day of Week| count|
+-----------+------+
|  Wednesday| 83594|
|    Tuesday| 68443|
|     Friday|101820|
|   Thursday| 82570|
|   Saturday|123263|
|     Monday| 70336|
|     Sunday|100790|
+-----------+------+
```

```
avg_distance = df.agg(avg("Trip Distance"))
avg_distance.show()
```

```
+------------------+
|avg(Trip Distance)|
+------------------+
|2909.7930553441893|
+------------------+
```

```
most_common_vendor = df.groupBy("Vendor").agg(count("*").alias("count")).orderBy("count", ascending=False)
most_common_vendor.show()
```

```
+------+------+
|Vendor| count|
+------+------+
|  lime|280092|
|  bird|181155|
|  spin|169569|
+------+------+
```

```
df = df.withColumn("Hour", df["Hour"].cast("int"))
```

```
avg_duration_per_hour = df.groupBy("Hour").agg(avg("Trip Duration")).orderBy("Hour", ascending=True)
avg_duration_per_hour.show(24, truncate=False)
```

```
+----+------------------+
|Hour|avg(Trip Duration)|
+----+------------------+
|0   |822.5294117647059 |
|1   |749.75            |
|2   |1551.5714285714287|
|3   |3137.769230769231 |
|4   |1017.1428571428571|
|5   |763.2114964073727 |
|6   |623.5370754265667 |
|7   |626.5774647887324 |
|8   |666.7079536891142 |
|9   |765.1482236953935 |
|10  |833.6979175484636 |
|11  |870.5916924713022 |
|12  |910.7220023693696 |
|13  |965.0152804864059 |
|14  |1021.4663506517807|
|15  |1047.8164449425203|
|16  |1078.7642150044996|
|17  |1046.3005251090897|
|18  |1052.6425674875682|
|19  |1084.4650725786987|
|20  |1088.46783625731  |
|21  |1061.3983138095105|
|22  |1294.0535117056857|
|23  |1616.8            |
+----+------------------+
from pyspark.sql import functions as F
from pyspark.sql.window import Window

window_spec = Window.partitionBy("Vendor").orderBy(F.col("Trip Distance").desc())

ranked_df = df.withColumn("Rank", F.dense_rank().over(window_spec))
second_highest_distance = ranked_df.filter(F.col("Rank") == 2)

second_highest_distance.show()
```

```
+--------------------+-------------------+--------------------+-------------+-------------+------+--------------------------+-
|             Trip ID|         Start Time|            End Time|Trip Distance|Trip Duration|Vendor|Start Community Area Number|E
+--------------------+-------------------+--------------------+-------------+-------------+------+--------------------------+-
|119e9b5f-ab7a-4dc...|2020-08-29 12:00:00|08/29/2020 01:00:...|       9998.0|         2700|  bird|                      49.0|
|99ec15d9-24e8-413...|2020-09-04 19:00:00|09/04/2020 08:00:...|       9998.0|         2400|  bird|                      74.0|
|98c46f8c-ce71-4a3...|2020-10-07 11:00:00|10/07/2020 11:00:...|       9998.0|          294|  bird|                      15.0|
|2c9a439e-2215-4f3...|2020-08-20 18:00:00|08/20/2020 07:00:...|       9998.0|         5228|  lime|                      69.0|
|a54f4a2e-30a4-48b...|2020-08-30 18:00:00|08/30/2020 06:00:...|       9998.0|         3262|  spin|                       8.0|
|c9d8ab72-443c-4a7...|2020-10-11 14:00:00|10/11/2020 02:00:...|       9998.0|         1599|  spin|                      19.0|
|d36ae161-de94-439...|2020-11-07 16:00:00|11/07/2020 06:00:...|       9998.0|         5579|  spin|                      28.0|
+--------------------+-------------------+--------------------+-------------+-------------+------+--------------------------+-
```